

EEBus UC Technical Specification

Configuration of DHW System

Function

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1 Scope of the document

This document describes the Use Case "Configuration of DHW System Function" (short-name: CDSF). Chapter 2 specifies the High-Level Use Case. Chapter 3 details the technical solution for SPINE for this Use Case. Within this document, a top-down approach is used to derive the requirements for the technical solution from the High-Level description.

1.1 References

1.1.1 EEBUS documents

[UseCaseBaseSpecification] EEBus_UC_TS_UseCaseBaseSpecification.pdf

[ProtocolSpecification] EEBus_SPINE_TS_ProtocolSpecification.pdf

[ResourceSpecification] EEBus_SPINE_TS_ResourceSpecification.pdf

[SHIP] SHIP_Specification_v1.0.0.pdf

1.1.2 Normative references

[RFC2119] IETF RFC 2119: 1997, Key words for use in RFCs to indicate requirement levels
Please see section 1.3.1 for details.

1.2 Terms and definitions

Actor

An Actor models a role within a Use Case definition (e.g. an energy manager or an electric vehicle).

CDSF

Configuration of DHW System Function (short name of this Use Case)

CEM

Abbreviation for Customer Energy Manager. The CEM is an energy manager located at the home or premises of the user or in a cloud application. The energy manager enables energy-optimized operation of the connected devices by harmonising energy demand and availability.

DHW

Abbreviation for Domestic Hot Water

HVAC

Abbreviation for Heat, Ventilation and Air Conditioning

Scenario

Part of a Use Case. Splitting a Use Case into Scenarios helps to understand the Use Case more quickly. Some Scenarios are mandatory for a Use Case, whereas others may be recommended or optional.

125 **Specialization**

126 Reusable data collection for a specific functionality.

127 **SPINE**

128 Smart Premises Interoperable Neutral-message Exchange: Technical Specification of EEBus Initiative
129 e.V.

130

131 **1.3 Requirements**

132 **1.3.1 Requirements wording**

133 The following keywords are used:

- 134 - SHALL
- 135 - SHALL NOT
- 136 - SHOULD
- 137 - SHOULD NOT
- 138 - MAY

139 Note: They apply only if written in capital letters.

140 For the meaning of the keywords, please refer to [RFC2119].

141

142 **1.3.2 Mapping of High-Level requirements**

143 Within the High-Level Use Case description, the following abbreviation is used:

144 [CDSF-xyz]

145 e.g.: [CDSF-007]

146 The abbreviation is used to mark High-Level requirements or rules of this Use Case with a unique
147 number xyz. These requirements are referenced throughout the technical solution to show how each
148 High-Level requirement is realized in the technical part.

149

2 High-Level description

2.1 Introduction

An HVAC (heating, cooling, ventilation or domestic hot water (DHW)) system function can be monitored or configured by an external appliance or viewing unit. The external appliance can be a Customer Energy Manager (CEM), a viewing unit (e.g. an HMI (human-machine-interface) like a smart home display/configurator) or an application on a tablet or smartphone. In this Use Case, a Configuration Appliance configures the system function DHW by changing the operation mode (e.g. on/off/auto/eco). In addition, the DHW appliance may support overrun operations such as a "One-time DHW loading"-function that overrides the current operation mode until it is finished or deactivated.

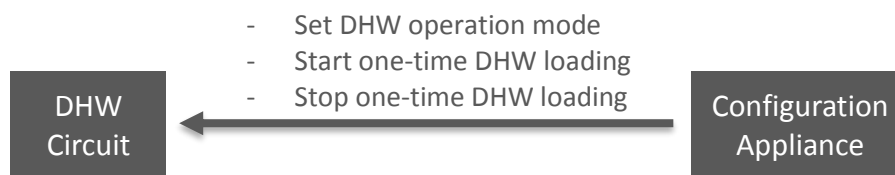


Figure 1: High-Level Use Case functionality overview

Added value: A DHW appliance may offer comfort functions through the smart home system or smart phone. For example, the user may switch the DHW Circuit from "auto" to "on" or start single domestic hot water heating as an "overrun" prior to taking a shower.

2.2 Actors

2.2.1 Configuration Appliance

The Actor Configuration Appliance (e.g. a CEM) controls the HVAC system functions or overruns of HVAC appliances.

2.2.2 DHW Circuit

The Actor DHW Circuit represents a circuit of domestic hot water in a house or premises.

2.3 Scenarios

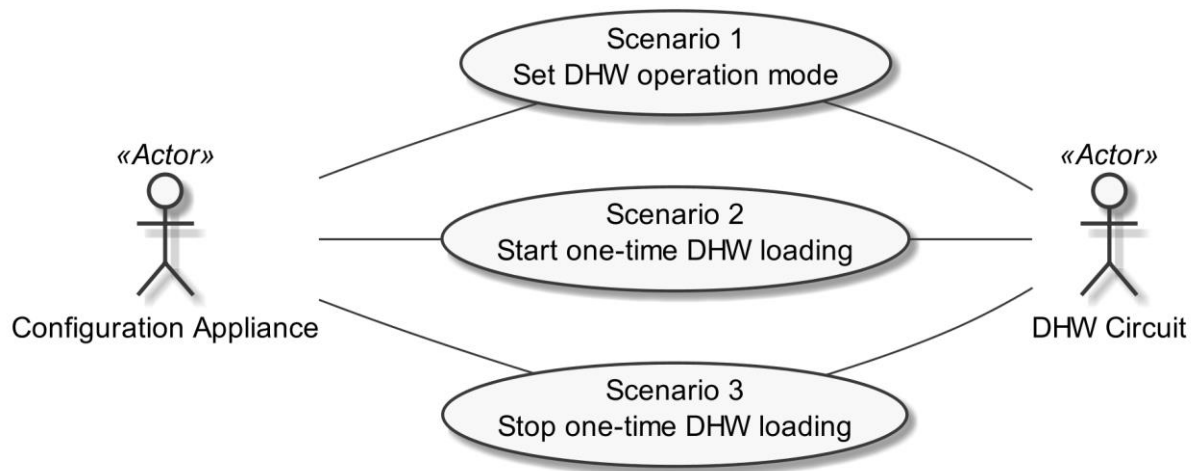


Figure 2: Scenario overview

Scenario number	Scenario name	Configuration Appliance	DHW Circuit
1	Set DHW operation mode	M	O*
2	Start one-time DHW loading	M	O*
3	Stop one-time DHW loading	R	O

Table 1: Scenario implementation requirements for Actors

*: At least one of the Scenarios SHALL be supported.

2.3.1 Scenario 1 - Set DHW operation mode

2.3.1.1 Description

The user sets the DHW operation mode [CDSF-001], for example "off", "on" or "auto" in order to adapt the DHW production ("never", "always", "time schedule based") to his personal needs.

2.3.1.2 Conditions

Triggering Event:

The Actor Configuration Appliance wants to change the system function information of the Actor DHW Circuit.

Pre-condition:

The Actor Configuration Appliance has not changed the system function information of the Actor DHW Circuit.

Post-condition:

The Actor Configuration Appliance has changed the system function information of the Actor DHW Circuit.

2.3.2 Scenario 2 - Start one-time DHW loading**2.3.2.1 Description**

The user starts a one-time DHW loading [CDSF-002] in order to quickly have domestic hot water.

2.3.2.2 Conditions**Triggering Event:**

The Actor Configuration Appliance wants to start the one-time DHW loading overrun of the Actor DHW Circuit.

Pre-condition:

The Actor Configuration Appliance has not started the one-time DHW loading overrun of the Actor DHW Circuit.

Post-condition:

The Actor Configuration Appliance has started the one-time DHW loading overrun of the Actor DHW Circuit.

2.3.3 Scenario 3 - Stop one-time DHW loading**2.3.3.1 Description**

The user stops a one-time DHW loading [CDSF-003] to stop the additional energy consumption of the one-time DHW loading, e.g. if the produced energy of a photovoltaic system decreases significantly.

2.3.3.2 Conditions**Triggering Event:**

The Actor Configuration Appliance wants to stop the one-time DHW loading overrun of the Actor DHW Circuit.

Pre-condition:

The Actor Configuration Appliance has not started the one-time DHW loading overrun of the Actor DHW Circuit.

225 **Post-condition:**

226 The Actor Configuration Appliance has started the one-time DHW loading overrun of the Actor DHW
227 Circuit.

228

229 **2.4 Dependencies to other Use Cases**

230 **2.4.1 "Configuration of DHW Temperature"**

231 The Use Case "Configuration of DHW Temperature" is linked to this Use Case. A server that provides
232 Scenarios of both Use Cases SHALL consider the following:

233 The server SHALL provide the Scenarios on the same Entity for both Use Cases.

234

235 **2.5 Assumptions and Prerequisites**

236 None.

237

3 Technical SPINE solution

3.1 General rules and information

3.1.1 Underlying technology documents

This technical solution relies on the SPINE Resources Specification version 1.1.0 [ResourceSpecification].

For interoperable connectivity this technical solution relies on:

- SPINE Protocol Specification version 1.1.0 [ProtocolSpecification] as application protocol.
- SHIP Specification version 1.0.0 [SHIP] as transport protocol.

Further applicable documents:

- EEBUS Use Case Base Specification version 1.0.0 [UseCaseBaseSpecification].

3.1.2 Use Case discovery rules

Use Case discovery SHOULD be supported by each Actor. If Use Case discovery is supported the following rules SHALL apply:

- The string content for the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName" within the Use Case discovery (please refer to [ProtocolSpecification]) SHALL be "configurationOfDhwSystemFunction". The string content SHALL only be defined by this Use Case (regardless of the Use Case version).
- The string content of the Element "nodeManagementUseCaseData. useCaseInformation. actor" within the Use Case discovery (please refer to [ProtocolSpecification]) SHALL be set to the according value stated within the corresponding Actor's section.
- An Actor A that is implemented to support this Use Case specification SHALL set the Element "nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion" within the Use Case discovery (please refer to [ProtocolSpecification]) to "1.0.0" (for details on the structure of the Use Case version number please refer to [UseCaseBaseSpecification]).
- If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.
- If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.
- If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

3.1.3 Rules for "Content of Specialization..." tables and "Content of Function..." tables

3.1.3.1 General presence indication definitions

Abbreviations for the presence indication of Elements listed in the tables are defined as follows:

Abbreviation	Meaning	Link to requirement keywords
M	Mandatory	SHALL
R	Recommended	SHOULD
O	Optional	MAY

Table 2: Presence indication description

An Actor MAY support Elements that are not listed in the tables. However, another Actor MAY ignore these Elements.

The presence indications "M", "R" and "O" are always meant relative to the respective parent Element. I.e. if a parent Element is optional ("O") and a child is mandatory ("M") the child Element can only be present if the parent Element is present as well.

Note: The indications and the aforementioned rules apply for "complete messages" (so-called "full function exchange", please refer to [ProtocolSpecification]). In contrast, the so-called "restricted function exchange" is designed to permit exchange of specific excerpts of data, i.e. fewer Elements than potentially available from the data owner (partially even not all "mandatory" Elements).

3.1.3.2 Presence indications for "Content of Specialization..." tables

This section only defines rules for the client side.

Elements that are marked with "M" SHALL be supported by the client in case of readable as well as writeable data. This Element may be optional on the server side.

The following applies for readable data that is exchanged in a "read/reply" or "notify" operation:

- "R" means that the data SHOULD be supported by the client. In other words: If the server responds with the according Element, the client SHOULD be able to interpret the according Elements.
- "O" means that the data MAY be supported by the client. In other words: If the server responds with the according Element, the client MAY be able to interpret the according Elements.

The following applies for writeable data that is exchanged in a "write" operation:

- "R" means that the data SHOULD be written by the client.
- "O" means that the data MAY be written by the client.
- "F" means that the data SHALL NOT be written by the client.

The following applies for Elements that are not listed in the Actor section:

- In case of a received "reply" message: The client MAY ignore the Element.
- In case of a "write" operation to be created: The client MAY set the Element but SHALL consider that the server may ignore the Element.

- In case of a received "notify" message: The client MAY ignore the Element.

M, R or O may be combined with the suffix "(event)" to express that a supported Element or value only has to be supported during a certain event and hence does not need to be present at all times. If the event is not active the Element may be omitted or another value may be set. In most cases a High-Level requirement reference for the event is given in the rules column.

3.1.3.3 Presence indications for "Content of Function..." tables

This section only defines rules for the server side.

Elements that are marked with "M" SHALL be supported by the server in case of readable as well as writeable data. In case of writeable data (marked with "M \W") the server does not need to set the Element, because the Element is set only by the client.

The following applies for readable data that is exchanged in a "read/reply" or "notify" operation:

- "R" means that the data SHOULD be provided by the server.
- "O" means that the data MAY be provided by the server.
- "F" means that the data SHALL NOT be provided by the server.

The following applies for writeable data that is exchanged in a "write" operation:

- "R" means that the data SHOULD be supported. In other words: If the client writes the Element, the server SHOULD accept those messages and the contained Elements.
- "O" means that the data MAY be supported. In other words: If the client writes the Element, the server MAY accept those messages and the contained Elements.

The following applies for Elements that are not listed in the Actor section:

- In case of a received "read" request: The according Element MAY be set in the reply.
- In case of a received "write" operation: The server MAY ignore the Element.
- In case of a "notify" operation to be created: The server MAY set the Element.

Note: The server will only accept write operations if the result fulfils the server Function requirements (permitted values, e.g.). Write operations on Elements that are not writeable MAY result in an error message.

M, R or O may be combined with the suffix "(event)" to express that a supported Element or value only has to be supported during a certain event and hence does not need to be present at all times. If the event is not active the Element may be omitted or another value may be set. In most cases a High-Level requirement reference for the event is given in the rules column.

3.1.3.4 Cardinality indications on Elements and list items

A cardinality indication on an Element or list item expresses constraints on the number of occurrences of a given Element or data set. In this section we use "X" as representation for such an Element or data set. Furthermore, "a" and "b" represent constraints. The following rules apply for the occurrence of "X" and its content related to a specific Scenario (see note underneath the list):

1. X
No cardinality indication.
2. X (a..b)
This means "X" SHALL occur at least "a" times and at maximum "b" times.
3. X (a..)
This means "X" SHALL occur at least "a" times and MAY occur more than "a" times.
4. X (..b)
This means "X" SHALL occur at maximum "b" times and MAY occur less than "b" times (even zero occurrences are permissive).

Note: These rules apply only under consideration of presence indications and with regards to the given Scenario or Function definition for this Use Case.

The following table is an example to explain this for two different placements.

Scenario [...]: M/R/O [W][C]	Element	Value	[High-Level Mapping] Element and value rules
...
2: M \W	xFeatureType. xListData. xData. (1..3)		
2: M \W	xId	<*(1..)>	PRIMARY IDENTIFIER
2: M \W	timePeriod		...
2: M \W	timePeriod. startTime	<xs:duration>	
2: M \W	xSlot. (1..)		
2: M \W	xSlot. xSlotId		...
2: M \W	xSlot. duration	<xs:duration>	...
...

Table 3: Example table for cardinality indications on Elements and list items

The field

xFeatureType. xListData. xData. (1..3)

introduces a data pattern (required Elements and values) for "xData" instances used for Scenario 2. The field itself specifies that such an "xData" instance SHALL occur at least 1 time and at maximum 3 times within "xListData" of Feature Type "xFeatureType". However, this constraint holds only for Scenario 2 and only if such "xData" are required. In this case, they are required, as the left field

2: M \W

denotes that this data set is mandatory for Scenario 2.

The field

xSlot. (1..)

expresses that the Element "xSlot" SHALL occur at least one time within its "xData", but MAY occur more than one time.

For the expression "<*(1..)>" of Element "xId" please see section 3.1.3.6.

The remaining fields do not have an explicit cardinality indication.

Note: Cardinality expressions are also used within placeholder expressions as defined in section 3.1.3.6. In many cases such placeholder expressions define the number of required or permitted Elements or list items as they explicitly define how many different values for a given Identifier are required or permitted for a given Scenario.

3.1.3.5 Writability and changeability indication

In the same column where the presence indications are denoted, a mark is used to distinguish between writeable, changeable or readable Elements:

- Elements that are marked with "\W" are written by a client and SHALL be writeable at the server according to their presence indications. The client is not obliged to read the according data. Received notifications do not need to be evaluated.
- Elements that are marked with "\C" are changed by a client and SHALL be changeable at the server according to their presence indications. The client is not obliged to read the according data. Received notifications do not need to be evaluated.
- Elements that are marked with "\RW" are read and written by a client and SHALL be writeable and provided by the server according to their presence indications. Received notifications SHALL be evaluated according to their presence indications.
- Elements that are marked with "\RC" are read and changed by a client and SHALL be changeable and provided by the server according to their presence indications. Received notifications SHALL be evaluated according to their presence indications.
- Elements that are not marked are only read by a client and SHALL be provided by the server according to their presence indications. Received notifications SHALL be evaluated according to their presence indications.

"Writeable" means that the Element and its value may be written by a client. This includes the possibility to modify (if the Element is already present), create (if the Element is not present yet), and delete the Element. The server SHALL adjust its Function according to the received "write" operation (unless the server cannot accept the "write" operation according to section 3.1.3.3).

"Changeable" means that the Element's value may be changed by a client. If the Element is not present at the resource before, it probably **cannot** be created by the client via the "write" operation. In this case the server MAY decline such a message.

Note: "\W" includes "\C" already.

Note: Depending on the resource a client might need to request a proper binding before the server accepts a "write" operation.

3.1.3.6 "Value" placeholders

3.1.3.6.1 Introduction

Specializations may use placeholders to model relations between different Elements or even list items of different Functions. The main purpose is to declare which Identifier values relate to each other. As a Use Case does not prescribe specific values to be used for a given Identifier, a placeholder like "<x1>" can be used in "Value" columns to express the intended relations.

There are two styles placeholders that can be referenced:

1. <xM>
2. <xM#S>

where

1. "x" is any alphabetical prefix like "m", "t", "ec", "cc", etc.
2. "M" is a (major) number like "1", "2", "15", etc.
3. "S" is a sub-number like "1", "7", "10", etc.

Examples for the first style are "<ec1>", "<z12>". Examples for the second style are "<p4#2>", "<m22#3>". For a given placeholder, only one of the styles can be used.

In addition, there are also styles for placeholders that do not need to be referenced:

1. <*>
2. <*#S>

The second style is only used with so-called cardinality expressions.

3.1.3.6.2 Uniqueness of placeholders

A given placeholder <xM> or <xM#S> represents the same value throughout a given Use Case specification for a given set of its parent Identifier values. This shall be explained in a brief example:

We assume a list item with PRIMARY IDENTIFIER "pId". It also has a SUB IDENTIFIER "sId" with placeholder "<s1>". Then, each occurrence of "<s1>" represents the same value for a given value of pId. This means that "<s1>" of a list item with pId=1 can differ from "<s1>" of a list item with pId=2. But it also means that "<s1>" represents the same value in all list items with pId=1.

Note: Typically, parent Identifiers like "pId" will also be expressed with a placeholder like "<p5>", e.g. In this case, the uniqueness rule applies for "<p5>" likewise.

Note: The uniqueness also applies for placeholders used as FOREIGN IDENTIFIER.

3.1.3.6.3 Placeholder expressions with cardinalities

For some Identifiers, more than one placeholder is needed. Several notations are used for this purpose, which make use of cardinality expressions. The general notation is as follows:

1. <xM#(a..b)>

442 This is equivalent to this explicit definition:

443 At least a and at maximum b placeholders of this list: <xM#1> <xM#2> ... <xM#b>

444 This means that the implementation of a given Use Case (or Scenario) requires a minimum of "a"
445 distinct values of the respective Identifier. In total, there can be up to "b" distinct values of the
446 respective Identifier.

447 Additionally, the following notations may occur:

448 2. <xM#(a..)>

449 This is equivalent to "<xM#(a..b)>" with "b" equal to infinity.

450 3. <xM#(..b)>

451 This is equivalent to "<xM#(a..b)>" with "a" equal to zero.

452 "<xM#(a..)>" has only a lower bound of "a" distinct values, but no upper bound. "<xM#(..b)>", on the
453 other hand, expresses that the Identifier may not be required at all, but it is permitted to have up to
454 "b" distinct values.

455 Similarly, the cardinality can be used for placeholders that are not referenced, i.e. <*(a..b)> etc.

456 Note: The cardinality does NOT express which of the sub-numbers have to be used! I.e., it does NOT
457 mean that the Identifiers <xM#1> ... <xM#a> are always used and just those with larger sub-numbers
458 (<xM#a+1> ... <xM#b>) are optional. If, for instance, a placeholder expression "<xM#(3..5)>" is given,
459 it may well happen that an implementation makes use of <xM#2>, <xM#4>, and <xM#5> (i.e., it does
460 NOT use <xM#1>, <xM#3>). Which sub-numbers are used usually depends on other parts of a
461 Specialization and their references to required placeholders, which is explained in section 3.1.3.6.4.

462

463 3.1.3.6.4 References to placeholders and relations

464 According to the styles for placeholders that can be referenced, an enumeration value "e" can refer
465 to a particular placeholder:

466 1. e(-><xM>)

467 2. e(-><xM#S>)

468 This denotes that "e" is to be used with "<xM>" or "<xM#S>", resp.

469 Example: A Specialization contains the Elements "mld" and "phase". "mld" is an Identifier with
470 placeholder definition <m2#(1..3)>. "phase" is a string that permits the values "a", "b", and "c" using
471 this expression:

472 "a"(-><m2#1>)

473 "b"(-><m2#2>)

474 "c"(-><m2#3>)

475 This expresses that the enumeration value "a" is to be used with the placeholder <m2#1>, "b" is to
476 be used with <m2#2> and "c" with <m2#3>.

477 Similarly, a placeholder "yN" can refer to a particular placeholder:

- 478 3. <yN->xM>
 479 4. <yN->xM#S>
 480 5. <yN#T->xM>
 481 6. <yN#T->xM#S>

482 where "T" is a sub-number of "yN".

483 It is also feasible to associate placeholders with cardinalities:

- 484 7. <yN#(a..b)->xM#(a..b)>

485 denotes that <yN#1> is to be used with <xM#1>, <yN#2> is to be used with <xM#2>, etc.

486 Note: In this case, the placeholder expressions of yN and xM must have the same cardinality.

487 In some cases, there is a need to express that multiple list items with similar values are feasible or
 488 required, but only particular combinations of these different data are permitted. The following
 489 example shows that several "fData" list items with different "phase" value are required, but that
 490 these list items may only express either the "phase" value combination { "a", "b", "c" } or the "phase"
 491 value combination { "a", "abb", "neutral" }. The permitted combinations are defined in a note below
 492 a table:

Scenario [...]: M/R/O [W][\C]	Element	Value	[High-Level Mapping] Element and value rules
2: M	F. fListData. fData.		
2: M	zId	<z3#(3..5)>	
2: M	phase	"a"(-><z3#1>)	
		"b"(-><z3#2>)	
		"c"(-><z3#3>)	
		"abc"(-><z3#4>)	
		"neutral"(-><z3#5>)	

493 Table 4: Content of an example Specialization

494 Note: One of the following combinations SHALL be used at least: {<z3#1>, <z3#2>, <z3#3>} or
 495 {<z3#1>, <z3#4>, <z3#5>}.
 496

497 3.1.3.7 Rules for content of "Value" column

498 For a given Scenario, the "Value" column may restrict the permitted content of a Function's Element
 499 to one or more particular values. This means that Elements with values deviating from the restriction
 500 (i.e. from the permitted values) do not belong to the respective Scenario and need to be considered
 501 as if the Element is not set. If more than one particular value is permitted for an Element, the values
 502 are in a single line each.

503 If a presence indication is set for the value (in an additional column before the value), the following
 504 rules SHALL be applied:

- "M" means that the value SHALL be supported. This means the value needs to be set at a certain point in time (depending on the value rules) or for a certain Element within a list entry.
- "R" means that the value SHOULD be supported.
- "O" means that the value MAY be supported.

If all possible values of a given mandatory Element are optional or recommended and this Element is used for the purpose of the respective Scenario, one of the values SHALL be set. If all possible values of a given optional or recommended Element are optional or recommended, this Element MAY contain also other values, but then this Element SHALL NOT be considered as part of the respective Scenario.

M, R or O may be combined with the suffix "(event)" to express that a supported value only has to be supported during a certain event and hence does not need to be present at all times. If the event is not active another value may be set. In most cases a High-Level requirement reference for the event is given in the rules column.

If no presence indication is set for the value, the following rules SHALL be applied:

- In case of Elements where the server may set or change an Element on its own (see section 3.1.3.5):
 - o within the tables in the "Server data - Resources" sections:
 - the server SHALL support at least one of the listed values.
 - o within the tables in the "Client data - Specializations" sections:
 - the client SHALL support all listed values.
- In case of Elements that are writable or changeable (see section 3.1.3.5):
 - o within the tables in the "Server data - Resources" sections:
 - the server SHALL support all listed values.
 - o within the tables in the "Client data - Specializations" sections:
 - the client SHALL support at least one of the listed values.

Depending on the Element, different values may be used during runtime. If this is the case, those rules are described within the value rules.

If a value is placed in parenthesis, the corresponding value is a recommendation. The actual value MAY deviate from this, e.g. "(1024)".

3.1.3.8 General information on how to interpret the "Content of Function..." and "Content of Specialization..." tables

Within the "Client data - Specializations" sections each Specialization is described in an own subsection with the name "Specialization "<name of the Specialization>" (e.g. "Specialization "Measurement_GridFeedInEnergy"). It contains only one table that includes all Elements needed for this Specialization. The different Functions are mentioned in a continuous row, highlighted with grey background colour. This row contains the following parts:

<Feature Type>. <Function>.[<list entry instance name>.]

544 The <list entry instance name> is only included if the <Function> is a list-based Function. An example
 545 could be:

546 DeviceConfiguration. deviceConfigurationKeyValueDescriptionListData.
 547 deviceConfigurationKeyValueDescriptionData.

548 In the following rows, only the names of the Elements are stated, without the prefix described above.

549

550 Within the "Server data - Resources" sections each Feature Type is described in an own sub-section
 551 with the name "Feature Type "<name of the Feature Type>"" (e.g. "Feature Type "Measurement"").
 552 It contains sub-sections for each Function named "Function "<name of the Function>"" (e.g.
 553 "Function "measurementListData""). These sections contain one table with all Elements needed for
 554 this resource. The list entries are mentioned in a continuous row, highlighted with grey background
 555 colour. This row contains the following parts:

556 <Feature Type>. <Function>.[<list entry instance name>.]

557 The <list entry instance name> is only included if the <Function> is a list-based Function. An example
 558 could be:

559 Measurement. measurementDescriptionListData. measurementDescriptionData.

560 In the following rows, only the names of the Elements are stated, without the prefix described above.

561

562 For both kinds of tables, the following applies:

- 563 - Parent Elements are marked with a dot at the end of the name:
 564 <parent Element>.
 565 E.g.:
 566 value.
- 567 - If there are sub-Elements, they are described in own rows with the name of the parent
 568 Element as prefix, separated by a dot and a blank space:
 569 <parent Element>. <sub-Element>
 570 E.g.:
 571 value. number

572

573 3.1.4 Rules for "Feature Types and Functions..." tables

574 3.1.4.1 Presence indications for "Feature Types and Functions..." tables

575 The following presence indications are used:

Abbreviation	Meaning	Link to requirement keywords
M	Mandatory	SHALL
R	Recommended	SHOULD
O	Optional	MAY

576 Table 5: Presence indication of Feature Types and Functions support

577 If at least one Function of a Feature has the presence indication "M", it is mandatory to support the
578 Feature.

579

580 **3.1.4.2 Rules for "Possible operations" column**

581 Within the "Feature Types and Functions..." tables the column "Possible operations" state whether
582 the Function is read- or writeable (as defined in the detailed discovery mechanism, see
583 [ProtocolSpecification]).

584 If the "partial" concept (also called "restricted function exchange") SHALL be supported, the
585 following notation is used (separated for read and write access):

586 read (M). partial (M)

587 write (M). partial (M)

588 If the "partial" concept SHOULD be supported, the following notation is used:

589 read (M). partial (R)

590 write (M). partial (R)

591 If the "partial" concept MAY be supported, the following notation is used:

592 read (M). partial (O)

593 write (M). partial (O)

594 The server can decide whether a notification is submitted complete or partial (as described in
595 [ProtocolSpecification]) if not defined differently within this Use Case Specification.

596

597 **3.1.5 "Actor ... overview" diagram rules**

598 Within the "Actor [...] overview" diagrams in the "Actors" sub-sections the complete functionality of
599 this Use Case is provided, including optional Scenarios. Which Scenarios are optional can be found in
600 Table 1. The Actor MAY have more functionality implemented than needed for this Use Case.

601 For the following Actor overview example, a brief description of the graphical symbols will be
602 described.

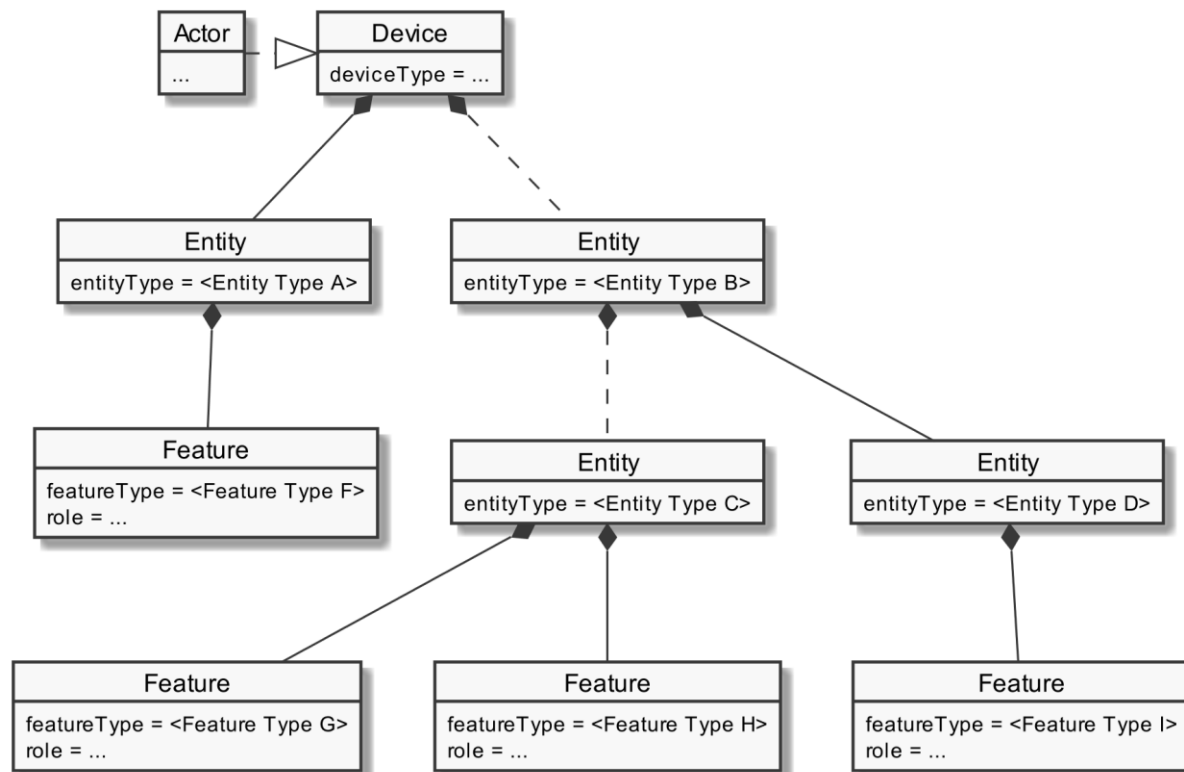


Figure 3: Actor overview example

The solid lines in the figure represent an immediate parent-childhood relation: The Entity with "<Entity Type A>" is a direct child of "Device". The Entity with "<Entity Type D>" is a direct child of the Entity with "<Entity Type B>". All Features are immediate child of the respective Entity.

The dashed lines in the figure express that there MAY be additional Entities between the shown Entities: A vendor's implementation MAY have one or more Entities between "Device" and the Entity with "<Entity Type B>". Likewise, a vendor's implementation MAY have one or more Entities between the Entity with "<Entity Type B>" and the Entity with "<Entity Type C>".

3.1.6 Specializations

Within the "Actors" sub-sections Specializations are referenced. A Specialization describes a dataset necessary to fulfil the specific requirements of a High-Level Use Case and its Scenarios. Often data from multiple different Features and Functions are needed to fulfil the requirements. Therefore, a Specialization defines a dataset that may encompass multiple related Functions from one or more different Features.

As different Use Cases sometimes share similar requirements, Specializations are also important from a re-usability perspective. This approach is used to improve consistency across Use Cases and avoid multiple variances of basically the same dataset. This is especially important in the case when an implementation supports multiple Use Cases. E.g. if a power measurement is necessary in two different Use Cases, both Use Cases could define slightly different datasets. In this case the server as well as the client functionality would have to implement both variances if both Use Cases are supported. This means, depending on the number of Use Cases, two or more datasets need to be

generated, transmitted and stored instead of one. Therefore, already existing Specializations specified within [UseCaseBaseSpecification] are used in this Use Case to avoid such problems.

If a Feature server can provide the data of a Specialization, the data does not necessarily always need to be available at the Feature server. There might be situations where the user deactivates a Use Case. There may also be other reasons why Use Case data cannot be provided currently. Therefore, a client always needs to be subscribed (as described in section 3.3.4) on the corresponding dataset to stay updated.

The SPINE resource description given in the "SPINE resources of the Actor" sections are derived from the Specializations given in the Actor's overview diagram. Please refer to [UseCaseBaseSpecification] for a detailed description of all Specializations.

3.1.7 Order of messages within the sequence diagrams

There are several sequence diagrams in this document describing message flows. The order of the messages SHOULD be kept by the communications partners, but there might be cases where a different order makes sense. The communications partners SHALL be able to handle the Scenario functionalities even if the messages are transmitted in a different order by the other Actor(s). The sequence diagrams can be seen as examples.

3.1.8 Further information and rules

None.

3.2 Actors

3.2.1 Configuration Appliance

3.2.1.1 Resource hierarchy

If Use Case discovery is supported (see section 3.1.2), this Actor SHALL be denoted as "ConfigurationAppliance" in the Element "nodeManagementUseCaseData. useCaseInformation. actor".

The following diagram provides an overview of the Actor Configuration Appliance's resource hierarchy.

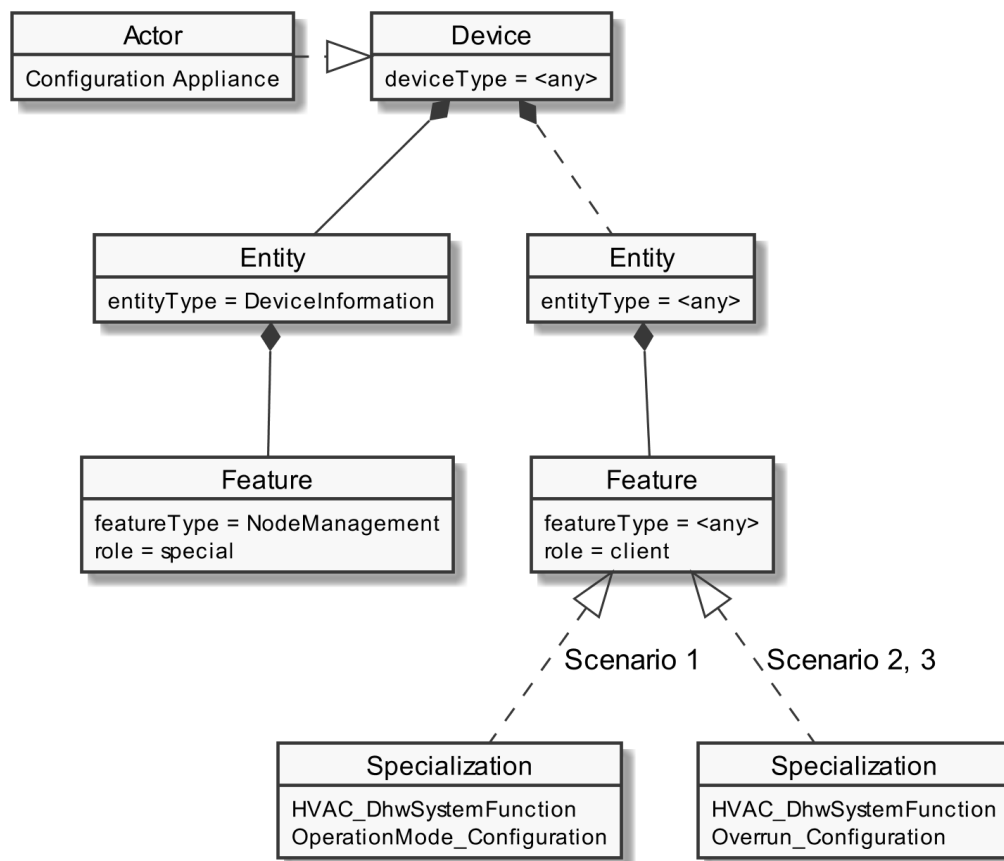


Figure 4: Actor "Configuration Appliance" overview

The "Actor ... overview" diagram rules" section describes how to interpret the diagram above. See the "Specializations" section for more information regarding the Specializations given in the diagram above.

Note: The entityType "DeviceInformation" with the featureType "NodeManagement" is required by the SPINE protocol and therefore SHALL be supported. Both types are added in the figure for completeness but are not directly linked to the Use Case.

The Use Case specific data follows behind any entityType. The Specializations represent the Scenario specific data that must be supported for each Scenario and are realized through the corresponding featureTypes.

If a Specialization is connected to a Feature with the role "client", the Actor has a client role for this data. This means that the Actor accesses the data set described by the Specialization at a corresponding server Feature. Further details are described in the sub-section "Client data - Specializations".

If a Specialization is connected to a Feature with the role "server", the Actor has the server role for this data. This means that the Actor must provide the corresponding data set of the Specialization as part of its Features. Further details are described in the sub-section "Server data - Resources".

3.2.1.2 Server data - Resources

As this Actor has only client functionality, no resources are described within this section.

3.2.1.3 Client data - Specializations

3.2.1.3.1 Topic "HVAC"

3.2.1.3.1.1 Specialization "HVAC_DhwSystemFunctionOperationMode_Configuration"

Scenario {...}: M/R/O [W][\C]	Element	Value	[High-Level Mapping] Element and value rules
1: M	HVAC. hvacSystemFunctionDescriptionListData. hvacSystemFunctionDescriptionData.		
1: M	systemFunctionId	<sf1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: M	systemFunctionType	"dhw"	SHALL be set.
1: M	HVAC. hvacOperationModeDescriptionListData. hvacOperationModeDescriptionData.		
1: M	operationModelId	<om1#(2..4)>	SHALL be set as PRIMARY IDENTIFIER.
1: M	operationModeType	"auto" (-><om1#1>)	
		"on" (-><om1#2>)	
		"off" (-><om1#3>)	
		"eco" (-><om1#4>)	
1: M	HVAC. hvacSystemFunctionOperationModeRelationListData. hvacSystemFunctionOperationModeRelationData.		
1: M	systemFunctionId	<sf1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: M	operationModelId	<om1#(2..4)>	SHALL be set as FOREIGN IDENTIFIER (at least two) to the according operationModelId of the referenced operation mode.
1: M	HVAC. hvacSystemFunctionListData. hvacSystemFunctionData.		
1: M	systemFunctionId	<sf1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: M \C	currentOperationModelId	<om1#1> <om1#2> <om1#3> <om1#4>	[CDSF-001] SHALL be set as FOREIGN IDENTIFIER to the according operationModelId of the currently selected operation mode. If the function hvacSystemFunctionOperationModeRelationListData is used, only an operationModelId value related there to the according systemFunctionId SHALL be used here.

1: M	isOperationModelIdChangeable	"true"	
------	------------------------------	--------	--

Table 6: Content of Specialization "HVAC_DhwSystemFunctionOperationMode_Configuration" at Actor Configuration Appliance

3.2.1.3.1.2 Specialization "HVAC_DhwSystemFunctionOverrun_Configuration"

Scenario [{...}]: M/R/O [W][C]	Element	Value		[High-Level Mapping] Element and value rules
2: M 3: M	HVAC. hvacSystemFunctionDescriptionListData. hvacSystemFunctionDescriptionData.			
2: M 3: M	systemFunctionId	<sf1#{1..1}>		SHALL be set as PRIMARY IDENTIFIER.
2: M 3: M	systemFunctionType	"dhw"		SHALL be set.
2: M 3: M	HVAC. hvacSystemFunctionListData. hvacSystemFunctionData.			
2: M 3: M	systemFunctionId	<sf1#{1..1}>		SHALL be set as PRIMARY IDENTIFIER.
2: M 3: M	isOverrunActive	"true" "false"		If an overrun is active that has an effect on this system function, this element SHOULD be set to "true".
2: M 3: M	HVAC. hvacOverrunDescriptionListData. hvacOverrunDescriptionData.			
2: M 3: M	overrunId	<o1#{1..1}>		SHALL be set as PRIMARY IDENTIFIER.
2: M 3: M	overrunType	"oneTimeDhw" *		SHALL be set.
2: M 3: M	affectedSystemFunctionId	<sf1#1>		If system functions are affected by this overrun, their according systemFunctionId SHOULD be stated here.
2: M 3: M	HVAC. hvacOverrunListData. hvacOverrunData.			
2: M 3: M	overrunId	<o1#{1..1}>		SHALL be set as PRIMARY IDENTIFIER.
2: M \C 3: M \C	overrunStatus	2: M \W 3: M	"active"	[CDSF-002]
		2: M 3: M	"running"	
		2: M 3: M	"finished"	MAY only be used as notification directly after HVAC overrun was finished. "overrunStatus" SHALL be changed to "inactive" after that. SHOULD NOT be used as part of a reply message.
		2: M 3: M \W	"inactive"	[CDSF-003]

				MAY be used as reply or as notification. The latter only, if HVAC overrun was not finished in the usual way (e.g., deactivated by the user).
--	--	--	--	---

Table 7: Content of Specialization "HVAC_DhwSystemFunctionOverrun_Configuration" at Actor Configuration Appliance

*: This enumeration list may be extended in future versions of this Use Case.

3.2.2 DHW Circuit

3.2.2.1 Resource hierarchy

If Use Case discovery is supported (see section 3.1.2), this Actor SHALL be denoted as "DHW Circuit" in the Element "nodeManagementUseCaseData. useCaseInformation. actor".

The following diagram provides an overview of the Actor DHW Circuit's resource hierarchy.

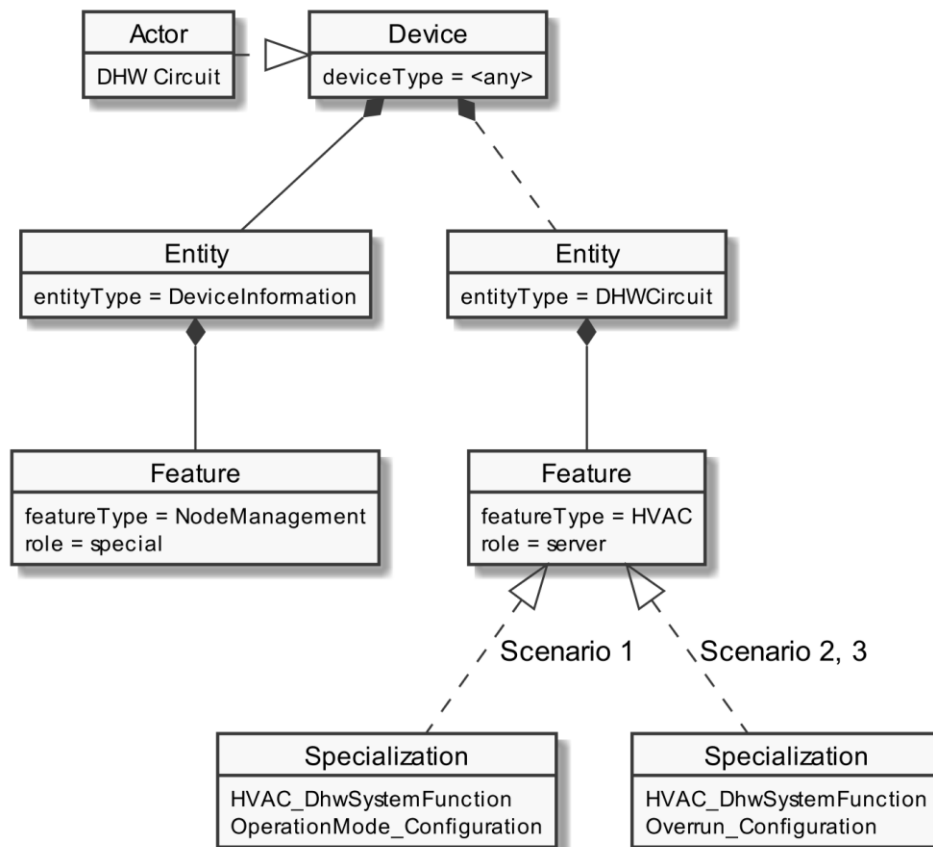


Figure 5: Actor "DHW Circuit" overview

The "Actor ... overview" diagram rules" section describes how to interpret the diagram above. See the "Specializations" section for more information regarding the Specializations given in the diagram above.

Note: The entityType "DeviceInformation" with the featureType "NodeManagement" is required by the SPINE protocol and therefore SHALL be supported. Both types are added in the figure for completeness but are not directly linked to the Use Case.

The Use Case specific data follows behind the entityType "DHWcircuit". The Specializations represent the Scenario specific data that must be supported for each Scenario and are realized through the corresponding featureTypes.

If a Specialization is connected to a Feature with the role "client", the Actor has a client role for this data. This means that the Actor accesses the data set described by the Specialization at a corresponding server Feature. Further details are described in the sub-section "Client data - Specializations".

If a Specialization is connected to a Feature with the role "server", the Actor has the server role for this data. This means that the Actor must provide the corresponding data set of the Specialization as part of its Features. Further details are described in the sub-section "Server data - Resources".

3.2.2.2 Server data - Resources

3.2.2.2.1 Overview

Behind the entityType "DHWcircuit", the Actor DHW Circuit SHALL offer the Feature Types and Functions given in the table below.

Feature Type	Scenario: M/R/O	Function	Possible operations
HVAC	1: M 2: M 3: M	hvacSystemFunctionDescriptionListData	read (M). partial (R)
	1: M	hvacOperationModeDescriptionListData	read (M). partial (R)
	1: M	hvacSystemFunctionOperationModeRelationListData	read (M). partial (R)
	1: M 2: M 3: M	hvacSystemFunctionListData	[1, 2] read (M). partial (R) [1] write (M). partial (R)
	2: M 3: M	hvacOverrunDescriptionListData	read (M). partial (R)
	2: M 3: M	hvacOverrunListData	read (M). partial (R) write (M). partial (R)

Table 8: Feature Types and Functions used within this Use Case by the Actor DHW Circuit

For each of these Feature Types, the following rule applies: There SHALL be at maximum one Feature with the Feature Type in the Entity.

Note: As a consequence of the previous rule, an implementation may need to have Feature data from different Scenarios/Specializations or even Use Cases in a given Feature.

The Scenario number shows in which Scenarios the DHW Circuit acts as a server and which Feature Types and Functions are relevant in each Scenario.

A detailed definition of the Elements and values that shall be supported in each Function is given in the following sub-sections.

Note: If in the table above "partial" read is not mentioned or is only optional, it still might be mandatory to support partial notifications. The details of "partial" support are described within the Scenario sections.

Note: The presence indications stated above are meant relative to the ones of the according Scenario stated in Table 1. I.e., if a Scenario is optional ("O") and a Feature Type is mandatory ("M"), the Feature Type need only be supported if the Scenario is supported, too.

Note: Further Features MAY be implemented on the same Entities; also, further Functions MAY be implemented in the used Entities.

3.2.2.2.2 Feature Type "HVAC"

3.2.2.2.2.1 Function "hvacSystemFunctionDescriptionListData"

Scenario [{...}]: M/R/O [\W][\C]	Element	Value	[High-Level Mapping] Element and value rules
1: M 2: M 3: M	HVAC. hvacSystemFunctionDescriptionListData. hvacSystemFunctionDescriptionData.		
1: M 2: M 3: M	systemFunctionId	<sf1#{1..1}>	SHALL be set as PRIMARY IDENTIFIER.
1: M 2: M 3: M	systemFunctionType	"dhw"	SHALL be set.

Table 9: Content of Function "hvacSystemFunctionDescriptionListData" at Actor DHW Circuit

3.2.2.2.2.2 Function "hvacOperationModeDescriptionListData"

Scenario [{...}]: M/R/O [\W][\C]	Element	Value	[High-Level Mapping] Element and value rules
1: M	HVAC. hvacOperationModeDescriptionListData. hvacOperationModeDescriptionData.		
1: M	operationModeId	<om1#{2..4}>	SHALL be set as PRIMARY IDENTIFIER.
1: M	operationModeType	"auto" (-><om1#1>)	
		"on" (-><om1#2>)	

		"off" (-><om1#3>)	
		"eco" (-><om1#4>)	

Table 10: Content of Function "hvacOperationModeDescriptionListData" at Actor DHW Circuit

3.2.2.2.2.3 Function "hvacSystemFunctionOperationModeRelationListData"

Scenario [{...}]: M/R/O [W][C]	Element	Value	[High-Level Mapping] Element and value rules
1: M	HVAC. hvacSystemFunctionOperationModeRelationListData. hvacSystemFunctionOperationModeRelationData.		
1: M	systemFunctionId	<sf1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: M	operationModelId	<om1#(2..4)>	SHALL be set as FOREIGN IDENTIFIER (at least two) to the according operationModelId of the referenced operation mode.

Table 11: Content of Function "hvacSystemFunctionOperationModeRelationListData" at Actor DHW Circuit

3.2.2.2.2.4 Function "hvacSystemFunctionListData"

Scenario [{...}]: M/R/O [W][C]	Element	Value	[High-Level Mapping] Element and value rules
1: M 2: M 3: M	HVAC. hvacSystemFunctionListData. hvacSystemFunctionData.		
1: M 2: M 3: M	systemFunctionId	<sf1#(1..1)>	SHALL be set as PRIMARY IDENTIFIER.
1: M C	currentOperationModelId	<om1#1> <om1#2> <om1#3> <om1#4>	[CDSF-001] SHALL be set as FOREIGN IDENTIFIER to the according operationModelId of the currently selected operation mode. If the function hvacSystemFunctionOperationModeRelationListData is used, only an operationModelId value related there to the according systemFunctionId SHALL be used here.
1: M	isOperationModelIdChangeable	"true"	
2: M 3: M	isOverrunActive	"true" "false"	If an overrun is active that has an effect on this system function, this element SHOULD be set to "true".

Table 12: Content of Function "hvacSystemFunctionListData" at Actor DHW Circuit

3.2.2.2.2.5 Function "hvacOverrunDescriptionListData"

Scenario [...]: M/R/O [W][C]	Element	Value	[High-Level Mapping] Element and value rules
2: M 3: M	HVAC. hvacOverrunDescriptionListData. hvacOverrunDescriptionData.		
2: M 3: M	overrunId	<o1#{1..1}>	SHALL be set as PRIMARY IDENTIFIER.
2: M 3: M	overrunType	"oneTimeDhw" *	SHALL be set.
2: M 3: M	affectedSystemFunctionId	<sf1#1>	If any system functions are affected by this overrun, their according systemFunctionId SHOULD be stated here.

Table 13: Content of Function "hvacOverrunDescriptionListData" at Actor DHW Circuit

*: This enumeration list may be extended in future versions of this Use Case.

3.2.2.2.2.6 Function "hvacOverrunListData"

Scenario [...]: M/R/O [W][C]	Element	Value	[High-Level Mapping] Element and value rules
2: M 3: M	HVAC. hvacOverrunListData. hvacOverrunData.		
2: M 3: M	overrunId	<o1#{1..1}>	SHALL be set as PRIMARY IDENTIFIER.
2: M \C 3: M \C	overrunStatus	2: M \W	"active"
		2: M	"running"
		2: M	"finished"
		2: M 3: M \W	"inactive"
			[CDSF-002]
			MAY only be used as notification directly after HVAC overrun was finished. "overrunStatus" SHALL be changed to "inactive" after that. SHOULD NOT be used as part of a reply message.
			[CDSF-003]
			MAY be used as reply or as notification. The latter only, if HVAC overrun was not finished in a usual way (deactivated by user, e.g.).

Table 14: Content of Function "hvacOverrunListData" at Actor DHW Circuit

752

753 **3.2.2.3 Client data - Specializations**

754 As this Actor has only server functionality, no Specializations are described within this section.

755

756 **3.3 Pre-Scenario communication**757 **3.3.1 General information**

758 The Pre-Scenario communication is needed if a client does not know the corresponding addresses on
759 the server or if the required subscriptions or bindings are not active. In this case certain general
760 communication mechanisms SHALL be used within SPINE:

- 761 a) Detailed discovery: allows to discover resource addresses.
- 762 b) Binding: allows to bind to resource address, which is frequently necessary to obtain write
763 privileges.
- 764 c) Subscription: allows to subscribe to resource addresses, which is necessary to receive
765 unsolicited notifications if a resource changes during runtime.

766 It is possible to combine those steps for multiple Scenarios or also multiple Use Cases:

- 767 - E.g. if multiple Scenarios in multiple Use Cases use the same Feature, only one subscription
768 needs to occur.
- 769 - E.g. a complete detailed discovery or a subscription to the NodeManagement Feature needs
770 to occur only once for all Use Cases.

771 Depending on which Entity, Feature and Functions are used within a Scenario the payload of the
772 corresponding messages may slightly differ, but the basic principles and messages used stay the
773 same.

774 The subsequent messages SHALL be exchanged for those parts that have not already been performed
775 since the current connection is established or if those parts are outdated for another reason (e.g. if
776 the detailed discovery is needed, but the bindings and subscriptions are still active from a previous
777 connection only the detailed discovery messages need to be exchanged). If all Pre-Scenario
778 communication parts are up-to-date, this section MAY be skipped, and the implementation can
779 proceed as described in the corresponding "Scenario communication" sections.

780 After the connection is re-established (e.g. due to a power loss or a firmware update) the Pre-
781 Scenario communication SHALL be performed as well. There may be circumstances where messages
782 from the Pre-Scenario communication may be exchanged again.

783 Often the necessary messages of different Scenarios can be combined, so that only one single
784 message is needed instead of multiple messages for the different Scenarios. This also is the case for
785 the Pre-Scenario communication. In most cases only one "read" operation on the detailed discovery
786 is necessary, as well as only one subscription request or binding request is needed for each Feature.
787 Often multiple Scenarios within a Use Case access the same Feature, so only one subscription or
788 binding is necessary.

789

3.3.2 Detailed discovery

For the functionality where a client already has current detailed discovery information (i.e. independent of this Use Case or any Scenario of it) the remainder of this section SHOULD be skipped.

Otherwise, the following procedure SHALL be performed in the given order:

1. If a client is not subscribed to the primary NodeManagement instance, the client SHALL acquire a subscription according to the figure provided within this sub-section.
2. A client SHALL read the detailed discovery information according to the figure provided within this sub-section. It SHALL keep the received information as far as it concerns mandatory and supported optional Entity Types, Feature Types and Functions of this Use Case that are needed by the client. This means that a client may choose how to store the necessary information. E.g. a client Actor can store the information how to address the necessary Features of the implemented Scenarios but may discard the Entity information.
3. If and as long as a client has a subscription to the detailed discovery information of an Actor and receives proper notifications, it SHALL consider (i.e. integrate into the kept detailed discovery information) the received information as far as it concerns mandatory and supported optional Entity Types, Feature Types and Functions of this Use Case.

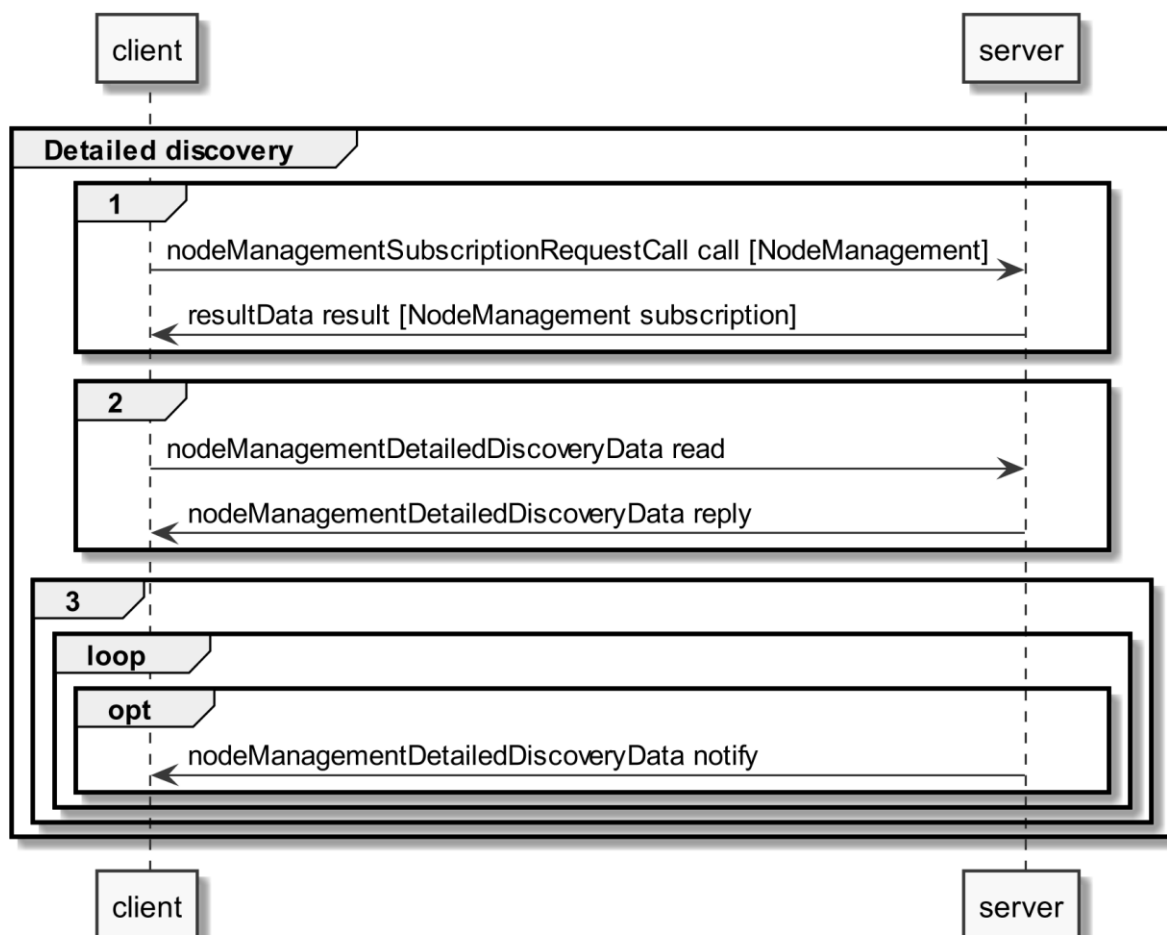


Figure 6: Pre-Scenario communication - Detailed discovery sequence diagram

If the "nodeManagementDetailedDiscoveryData read" fails, the client SHOULD retry to read the detailed discovery information until the "nodeManagementDetailedDiscoveryData reply" message was received successfully.

811 If all functionality is present at all times: The "nodeManagementDetailedDiscoveryData reply"
 812 message contains at least the mandatory Entities and Features given in the "Actor [...] overview"
 813 diagrams as well as the used Functions and their "possible operations" described in section 3.2 and
 814 its sub-sections.

815 If functionality is added or removed dynamically: The "nodeManagementDetailedDiscoveryData
 816 reply" message does not need to contain all mandatory Entities and Features given in the "Actor [...]
 817 overview" diagrams as well as all needed Functions and their "possible operations" described in
 818 section 3.2 and its sub-sections. However, as soon as the functionality is available it will be
 819 announced via a "nodeManagementDetailedDiscoveryData notify" message.

820 For the nodeManagementDetailedDiscoveryData read Function it is recommended to use a partial
 821 read with separated Selectors that may use one of the following Elements:

- 822 - entityType
- 823 - featureType

824 Note: Even with the usage of Selectors Features and Entities that are not relevant for this Use Case
 825 may be discovered. However, only Features and Entities that fulfil the hierarchical order as described
 826 within the Actors' sections shall be considered for this Use Case.

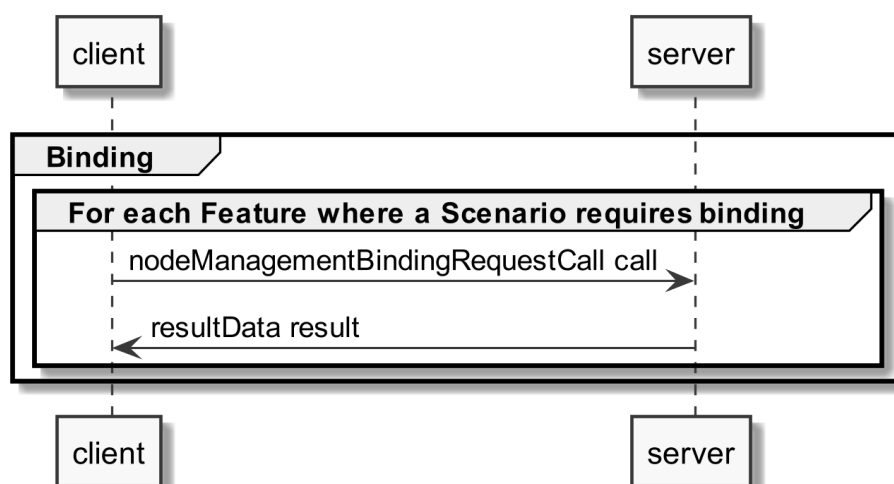
827 A "partial" notify SHALL be supported without using Selectors and Elements. Partial "delete" notify
 828 SHOULD also be supported with separated Selectors that may use one of the following Elements:

- 829 - entityAddress
- 830 - featureAddress

831

832 3.3.3 Binding

833 If binding is required by a Scenario that uses Features with writeable or changeable data, the server
 834 SHALL support binding for the respective Features. Before a write on a Function of a Feature occurs,
 835 the client SHALL create a binding to the corresponding Feature. For this the
 836 nodeManagementBindingRequestCall Function is used as shown in the following sequence diagram:



837

838 Figure 7: Pre-Scenario communication - Binding sequence diagram

If functionality is added or removed dynamically, binding may not be possible at all times on the required Functions. A client SHALL retry to create a binding again when receiving according updated detailed discovery information.

3.3.4 Subscription

A server SHALL support subscription for all Features that contain readable data that may change during runtime. The client SHALL create a subscription for all Features that the client wants to read. For this the nodeManagementSubscriptionRequestCall Function is used as shown in the following sequence diagram:

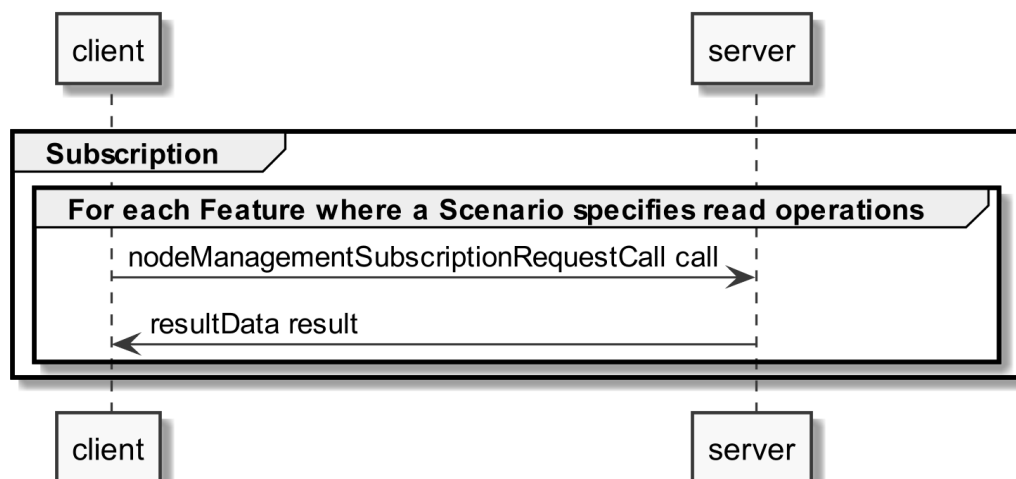


Figure 8: Pre-Scenario communication - Subscription sequence diagram

If the subscription request fails (e.g. because it is not supported by the server or the maximum number of possible subscriptions is reached), the client SHOULD read the data periodically (so-called "polling").

If functionality is added or removed dynamically, subscription may not be possible at all times on the required Functions. A client SHALL retry its subscription procedure again when receiving according updated detailed discovery information.

3.3.5 Dynamic behaviour

In case Entities or Features are removed, a nodeManagementDetailedDiscoveryData "notify" is transmitted that informs about the deleted Entities and Features. All existing binding or subscription entries on the deleted Features SHALL be deleted by each device.

In case Entities or Features are added the Pre-Scenario communication starts with transmitting a nodeManagementDetailedDiscoveryData "notify" that contains the added Entities and Features.

3.4 Scenarios

3.4.1 Scenario 1 - Set DHW operation mode

3.4.1.1 Pre-Scenario communication

1. **Detailed discovery:** Actors that act as client within this Scenario, need to know the addresses of the server Features used in the Initial Scenario communication. If the address of a particular server Feature is not known, the detailed discovery must be used, as described in section 3.3.2.
2. **Binding:** Binding SHOULD NOT be used for this Scenario.
3. **Subscription:** Actors SHALL create a subscription for each server Feature that is relevant for the corresponding Actor within this Scenario, as described in section 3.3.4.

The Initial Scenario communication SHALL start at the latest when the required resources on an Actor are known and the necessary binding and subscription procedures have been finished. However, as soon as the address of a required resource is known, the Initial Scenario communication for this resource MAY start already, even if the addresses of other required resources are not known yet.

If required resources are removed and added again, they are re-discovered, and the Initial Scenario communication is triggered again for those resources.

3.4.1.2 Initial Scenario communication

Each time a (re-)connection is established, even if the Pre-Scenario communication phase is skipped, the messages shown in the following sequence diagram SHALL be exchanged, as the corresponding resources may have changed in the meantime:

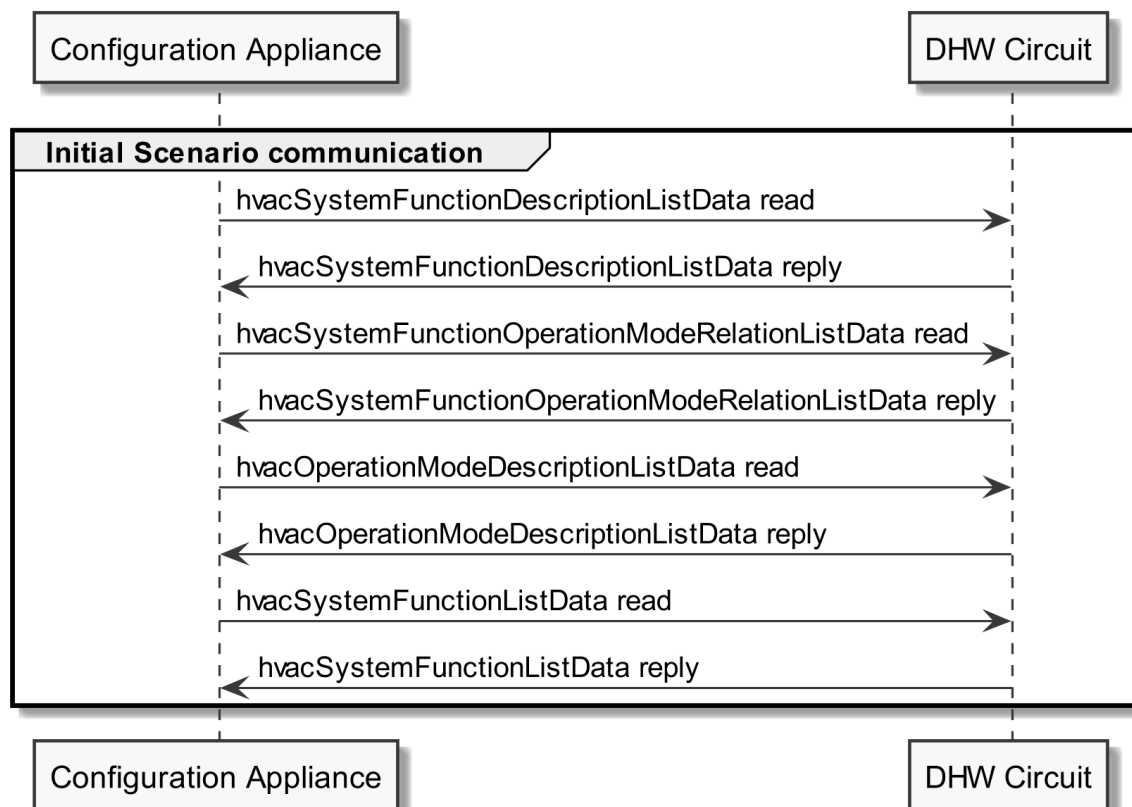


Figure 9: Scenario 1 - Initial Scenario communication sequence diagram

The hvacSystemFunctionDescriptionListData read SHOULD be a "partial" read operation with the following Selector:

- systemFunctionType = "dhw"

The hvacSystemFunctionOperationModeRelationListData read SHOULD be a "partial" read operation with the following Selector:

- systemFunctionId (derived from the hvacSystemFunctionDescriptionListData reply)

The hvacOperationModeDescriptionListData read SHOULD be a "partial" read operation with the following Selector:

- operationModelId (derived from the hvacSystemFunctionOperationModeRelationListData reply)

The hvacSystemFunctionListData read SHOULD be a "partial" read operation with the following Selector:

- systemFunctionId (derived from the hvacSystemFunctionDescriptionListData reply)

Note: If partial read is not supported a full read SHALL be performed.

The following table shows where the required content of the messages from the sequence diagram is described:

Message name from sequence diagram	Content description in table	Scenario number in table
hvacSystemFunctionDescriptionListData reply	Table 9	1
hvacOperationModeDescriptionListData reply	Table 10	1
hvacSystemFunctionOperationModeRelationListData reply	Table 11	1
hvacSystemFunctionListData reply	Table 12	1

Table 15: Initial Scenario communication content references for Scenario 1

Note: Within the Initial Scenario communication, the content required by this Scenario MAY not be provided completely, but later during Runtime Scenario communication.

3.4.1.3 Runtime Scenario communication

Based on the Initial Scenario communication the Runtime Scenario communication provides updates during runtime.

If one of the referenced server Functions' data change, the server SHALL submit the change as shown in the following figure:

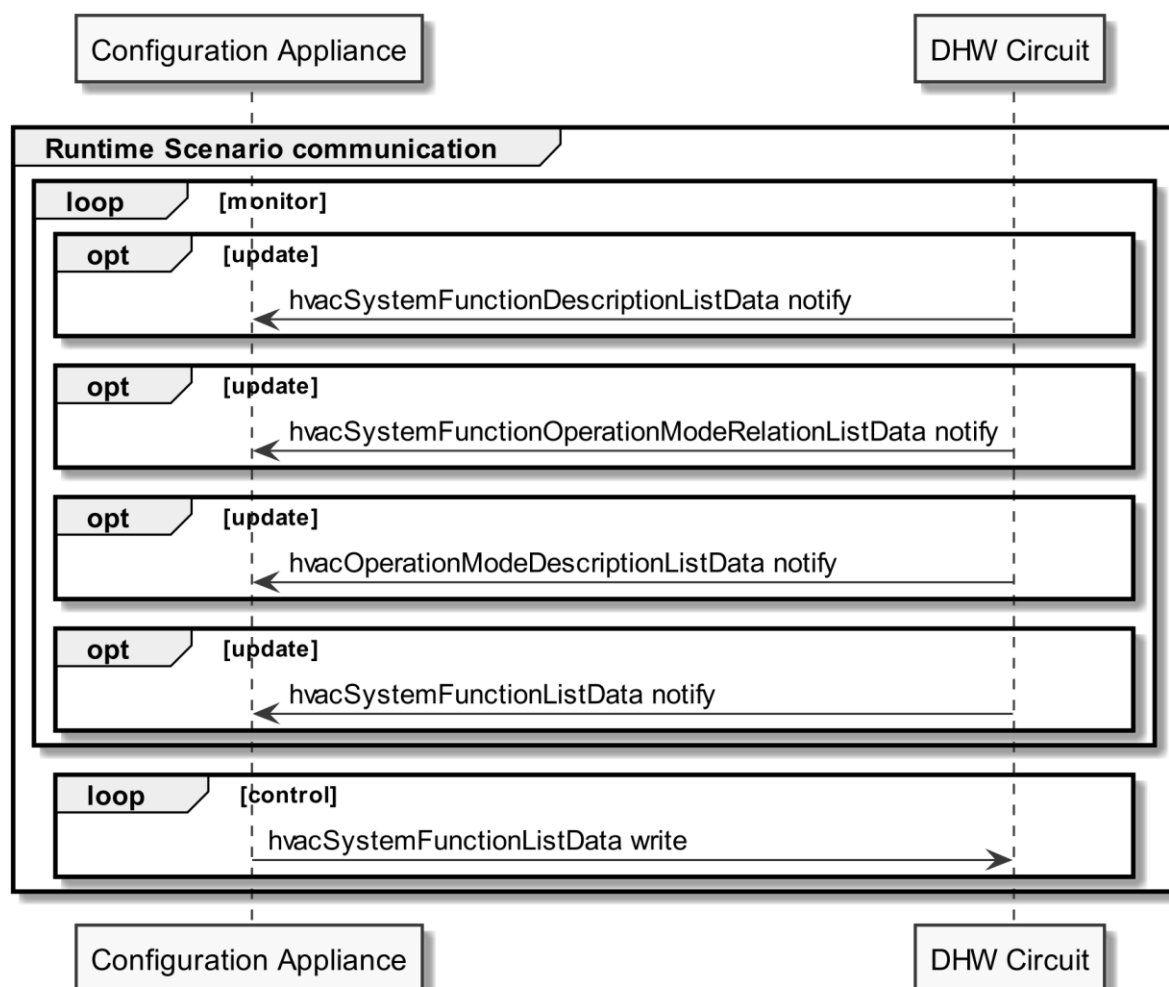


Figure 10: Scenario 1 - Runtime Scenario communication sequence diagram

915 Partial notifications without Selectors or Elements SHALL be supported for all Functions used in this
 916 Scenario.

917 For hvacSystemFunctionDescriptionListData notify,
 918 hvacSystemFunctionOperationModeRelationListData notify and hvacSystemFunctionListData notify
 919 "partial" delete notifications SHOULD be supported with the Selector:

920 - systemFunctionId

921 For hvacOperationModeDescriptionListData notify "partial" delete notifications SHOULD be
 922 supported with the Selectors:

923 - operationModeId

924 However, in general the client SHOULD NOT perform a partial delete write in this Scenario.

925 Note: To interpret partial notification messages correctly the information obtained during the Initial
 926 Scenario communication phase is necessary.

927 Note: A read operation ("polling") on all Functions is possible at any time, e.g. if a notification could
 928 not be evaluated.

929

930 The following table shows where the required content of the messages of the sequence diagram is
 931 described:

Message name from sequence diagram	Content description in table	Scenario number in table
hvacSystemFunctionDescriptionListData notify	Table 9	1
hvacOperationModeDescriptionListData notify	Table 10	1
hvacSystemFunctionOperationModeRelationListData notify	Table 11	1
hvacSystemFunctionListData notify	Table 12	1
hvacSystemFunctionListData write	Table 12	1

932 Table 16: Runtime Scenario communication content references for Scenario 1

933

934 3.4.1.4 Additional information

935 None.

936

937 3.4.2 Scenario 2 - Start one-time DHW loading

938 3.4.2.1 Pre-Scenario communication

- 939 1. **Detailed discovery:** Actors that act as client within this Scenario, need to know the addresses
 940 of the server Features used in the Initial Scenario communication. If an address of a
 941 particular server Feature is not known, the detailed discovery must be used, as described in
 942 section 3.3.2.
- 943 2. **Binding:** Binding SHOULD NOT be used for this Scenario.

3. **Subscription:** Actors SHALL create a subscription for each server Feature that is relevant for the corresponding Actor within this Scenario, as described in section 3.3.4.

The Initial Scenario communication SHALL start at the latest when the required resources on an Actor are known and the necessary binding and subscription procedures have been finished. However, as soon as the address of a required resource is known, the Initial Scenario communication for this resource MAY start already, even if the addresses of other required resources are not known yet.

If required resources are removed and added again, they are re-discovered, and the Initial Scenario communication is triggered again for those resources.

3.4.2.2 Initial Scenario communication

Each time a (re-)connection is established, even if the Pre-Scenario communication phase is skipped, the messages shown in the following sequence diagram SHALL be exchanged, as the corresponding resources may have changed in the meantime:

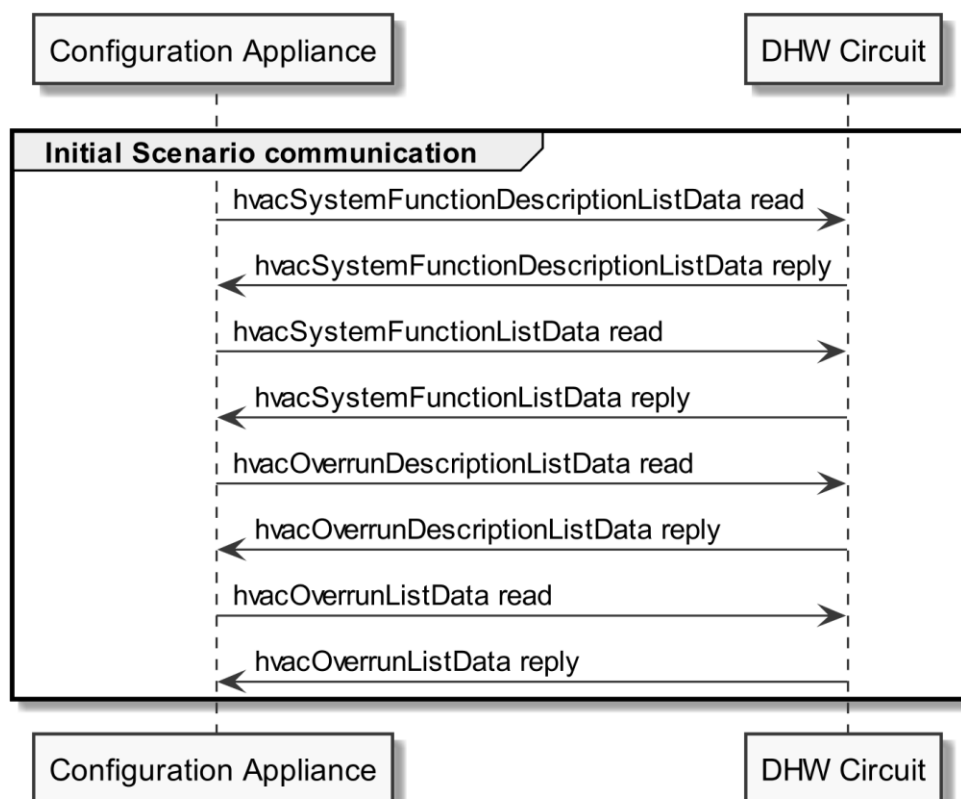


Figure 11: Scenario 2 - Initial Scenario communication sequence diagram

The hvacSystemFunctionDescriptionListData read SHOULD be a "partial" read operation with the following Selector:

- systemFunctionType = "dhw"

The hvacSystemFunctionListData read SHOULD be a "partial" read operation with the following Selector:

- systemFunctionId (derived from the hvacSystemFunctionDescriptionListData reply)

965 The hvacOverrunDescriptionListData read SHOULD be a "full" read operation.

966 The hvacOverrunListData read SHOULD be a "partial" read operation with the following Selectors:

- 967 - overrunId (derived from the hvacOverrunDescriptionListData reply, filtered for overrunType
- 968 = "oneTimeDhw" and affectedSystemFunctionId = systemFunctionId (derived from the
- 969 hvacSystemFunctionDescriptionListData reply)

970 Note: If partial read is not supported, a full read SHALL be performed.

971

972 The following table shows where the required content of the messages from the sequence diagram is
973 described:

Message name from sequence diagram	Content description in table	Scenario number in table
hvacSystemFunctionDescriptionListData reply	Table 9	2
hvacSystemFunctionListData reply	Table 10	2
hvacOverrunDescriptionListData reply	Table 13	2
hvacOverrunListData reply	Table 14	2

974 *Table 17: Initial Scenario communication content references for Scenario 2*

975 Note: Within the Initial Scenario communication, the content required by this Scenario MAY not be
976 provided completely, but later during Runtime Scenario communication.

977

978 **3.4.2.3 Runtime Scenario communication**

979 Based on the Initial Scenario communication the Runtime Scenario communication provides updates
980 during runtime.

981 If one of the referenced server Functions' data change, the server SHALL submit the change as shown
982 in the following figure:

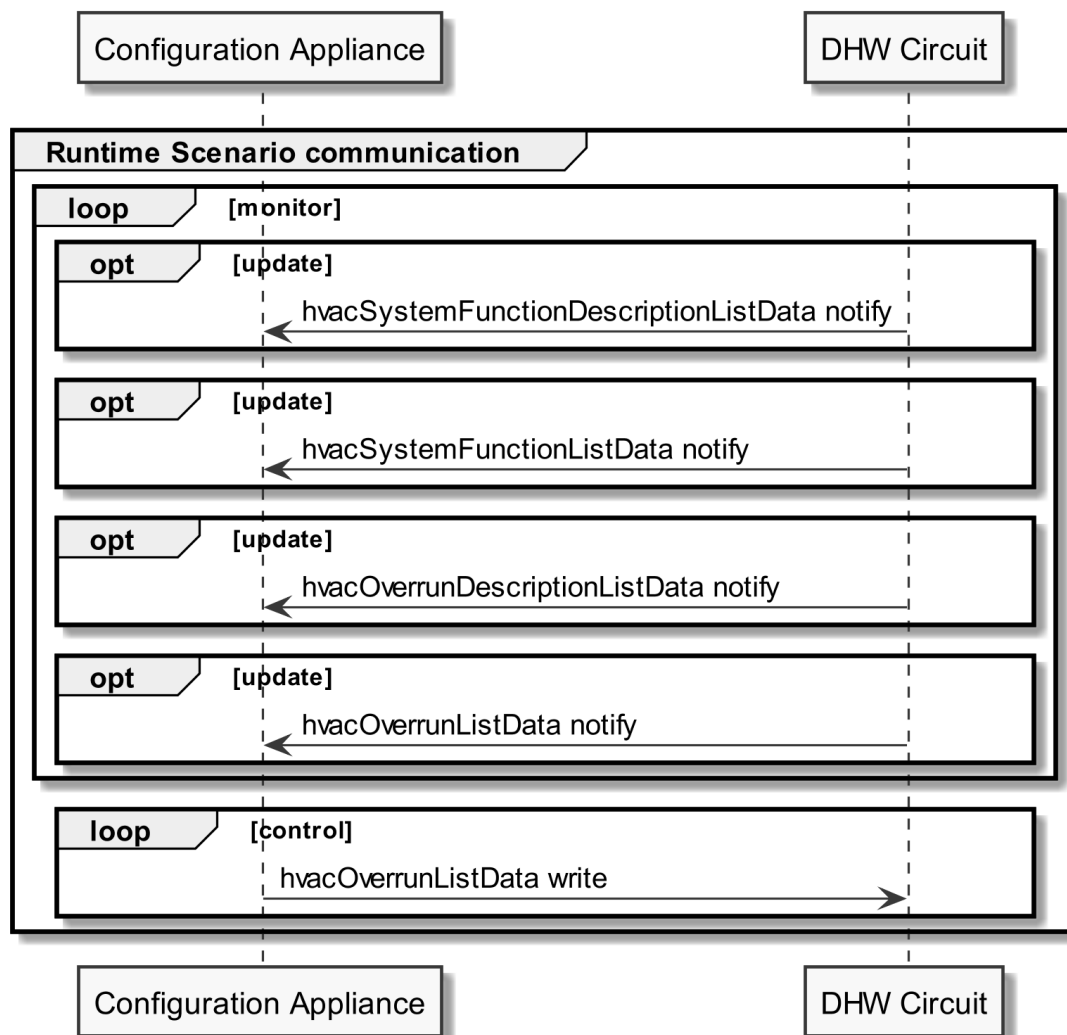


Figure 12: Scenario 2 - Runtime Scenario communication sequence diagram

Partial notifications without Selectors or Elements SHALL be supported for all Functions used in this Scenario.

For hvacSystemFunctionDescriptionListData notify and hvacSystemFunctionListData notify, "partial" delete notifications SHOULD be supported with the Selector:

- systemFunctionId

For hvacOverrunDescriptionListData notify and hvacOverrunListData notify "partial" delete notifications SHOULD be supported with the Selectors:

- overrunId

However, in general, the client SHOULD NOT perform a partial delete write in this Scenario.

Note: To interpret partial notification messages correctly, the information obtained during the Initial Scenario communication phase is necessary.

Note: A read operation ("polling") on all Functions is possible at any time, e.g. if a notification could not be evaluated.

998

999 The following table shows where the required content of the messages of the sequence diagram is
 1000 described:

Message name from sequence diagram	Content description in table	Scenario number in table
hvacSystemFunctionDescriptionListData reply	Table 9	2
hvacSystemFunctionListData reply	Table 10	2
hvacOverrunDescriptionListData reply	Table 13	2
hvacOverrunListData reply	Table 14	2
hvacOverrunListData write	Table 14	2

1001 *Table 18: Runtime Scenario communication content references for Scenario 2*

1002

1003 **3.4.2.4 Additional information**

1004 None.

1005

1006 **3.4.3 Scenario 3 - Stop one-time DHW loading**

1007 **3.4.3.1 Pre-Scenario communication**

1008 1. **Detailed discovery:** Actors that act as client within this Scenario, need to know the addresses
 1009 of the server Features used in the Initial Scenario communication. If an address of a
 1010 particular server Feature is not known, the detailed discovery must be used, as described in
 1011 section 3.3.2.

1012 2. **Binding:** Binding SHOULD NOT be used for this Scenario.

1013 3. **Subscription:** Actors SHALL create a subscription for each server Feature that is relevant for
 1014 the corresponding Actor within this Scenario, as described in section 3.3.4.

1015 The Initial Scenario communication SHALL start at the latest when the required resources on an Actor
 1016 are known and the necessary binding and subscription procedures have been finished. However, as
 1017 soon as the address of a required resource is known, the Initial Scenario communication for this
 1018 resource MAY start already, even if the addresses of other required resources are not known yet.

1019 If required resources are removed and added again, they are re-discovered, and the Initial Scenario
 1020 communication is triggered again for those resources.

1021

1022 **3.4.3.2 Initial Scenario communication**

1023 Each time a (re-)connection is established, even if the Pre-Scenario communication phase is skipped,
 1024 the messages shown in the following sequence diagram SHALL be exchanged, as the corresponding
 1025 resources may have changed in the meantime:

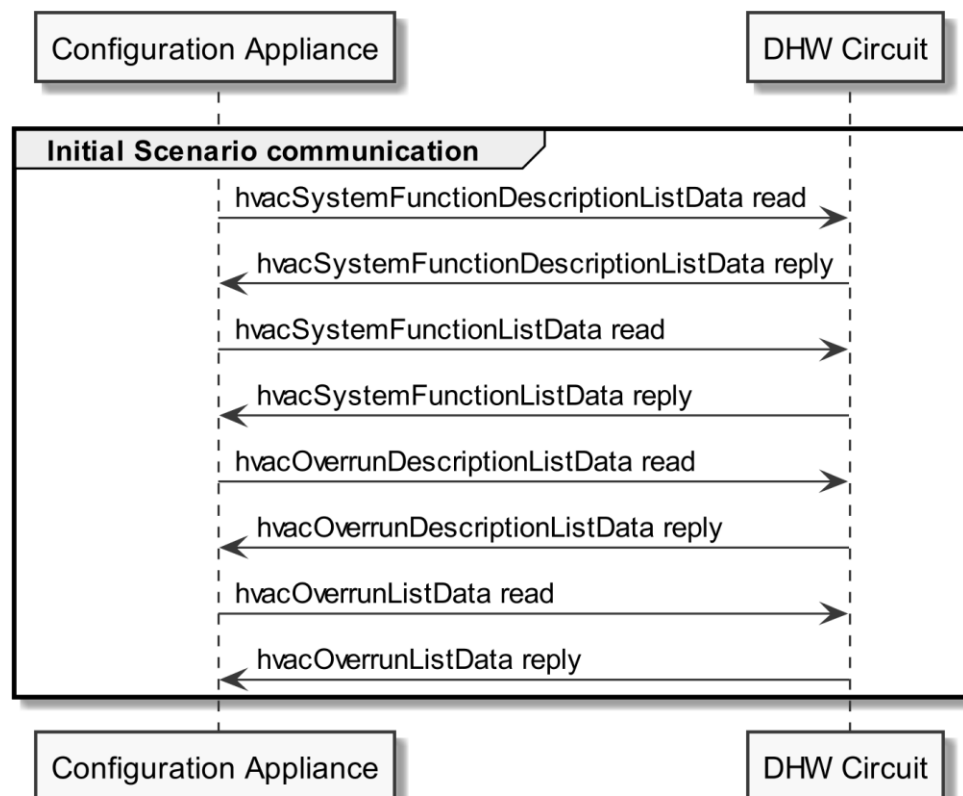


Figure 13: Scenario 3 - Initial Scenario communication sequence diagram

The hvacSystemFunctionDescriptionListData read SHOULD be a "partial" read operation with the following Selector:

- systemFunctionType = "dhw"

The hvacSystemFunctionListData read SHOULD be a "partial" read operation with the following Selector:

- systemFunctionId (derived from the hvacSystemFunctionDescriptionListData reply)

The hvacOverrunDescriptionListData read SHOULD be a "full" read operation.

The hvacOverrunListData read SHOULD be a "partial" read operation with the following Selectors:

- overrunId (derived from the hvacOverrunDescriptionListData reply, filtered for overrunType = "oneTimeDhw" and affectedSystemFunctionId = systemFunctionId (derived from the hvacSystemFunctionDescriptionListData reply))

Note: If partial read is not supported, a full read SHALL be performed.

The following table shows where the required content of the messages from the sequence diagram is described:

Message name from sequence diagram	Content description in table	Scenario number in table
hvacSystemFunctionDescriptionListData reply	Table 9	3

hvacSystemFunctionListData reply	Table 10	3
hvacOverrunDescriptionListData reply	Table 13	3
hvacOverrunListData reply	Table 14	3

Table 19: Initial Scenario communication content references for Scenario 3

Note: Within the Initial Scenario communication, the content required by this Scenario MAY not be provided completely, but later during Runtime Scenario communication.

3.4.3.3 Runtime Scenario communication

Based on the Initial Scenario communication the Runtime Scenario communication provides updates during runtime.

If one of the referenced server Functions' data change, the server SHALL submit the change as shown in the following figure:

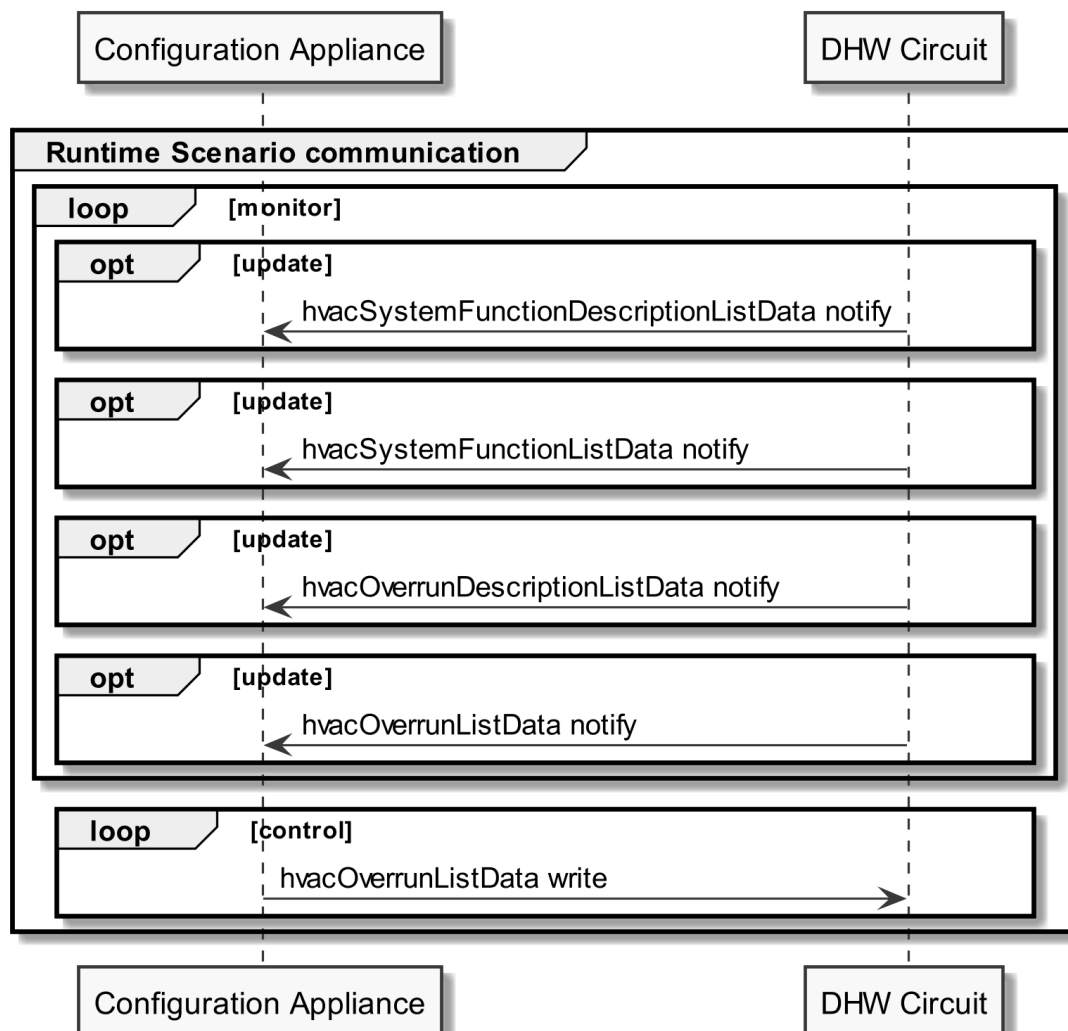


Figure 14: Scenario 3 - Runtime Scenario communication sequence diagram

Partial notifications without Selectors or Elements SHALL be supported for all Functions used in this Scenario.

1056 For hvacSystemFunctionDescriptionListData notify and hvacSystemFunctionListData notify, "partial"
 1057 delete notifications SHOULD be supported with the Selector:

1058 - systemFunctionId

1059 For hvacOverrunDescriptionListData notify and hvacOverrunListData notify "partial" delete
 1060 notifications SHOULD be supported with the Selectors:

1061 - overrunId

1062 However, in general, the client SHOULD NOT perform a partial delete write in this Scenario.

1063 Note: To interpret partial notification messages correctly, the information obtained during the Initial
 1064 Scenario communication phase is necessary.

1065 Note: A read operation ("polling") on all Functions is possible at any time, e.g. if a notification could
 1066 not be evaluated.

1067

1068 The following table shows where the required content of the messages of the sequence diagram is
 1069 described:

Message name from sequence diagram	Content description in table	Scenario number in table
hvacSystemFunctionDescriptionListData reply	Table 9	3
hvacSystemFunctionListData reply	Table 10	3
hvacOverrunDescriptionListData reply	Table 13	3
hvacOverrunListData reply	Table 14	3
hvacOverrunListData write	Table 14	3

1070 *Table 20: Runtime Scenario communication content references for Scenario 3*

1071

1072 **3.4.3.4 Additional information**

1073 None.

1074